Application No. 10/594,307
Client Docket: NE353-PCT(US) (Attorney Docket: TAK.054)

AMENDMENTS TO THE CLAIMS:

1. (Previously Presented) A tunable laser, comprising:

a multiple ring resonator in which a plurality of ring resonators, which are constituted with ring-type waveguides having optical path lengths different from each other, are coupled through an optical-coupling device;

an LD-side waveguide having a first end connected to one of the plurality of ring resonators through an optical-coupling device;

a reflection-side waveguide having a first end connected to other one of the plurality of ring resonators through an optical-coupling device;

a single board on which the ring resonator, the LD-side waveguide and the reflection-side waveguide are formed;

a reflection film provided to a second end of the reflection-side waveguide, wherein said reflection film comprises a high-reflection film capable of reflecting laser light without regard to a wavelength of a transmission peak of said laser light;

a laser diode chip having a low reflection film formed on one of two opposing emission end faces, which is optically coupled to the LD-side waveguide through the low reflection film; and

a tuning device for changing a resonance wavelength of only the multiple ring resonator,

wherein, in the plurality of ring resonators, diameters of the ring waveguides are set so that intervals of reflection peaks appearing periodically become different, and there generates a resonance at a meeting point of the reflection peaks.

2. (Original) The tunable laser as claimed in claim 1, wherein the multiple ring resonator contains at least two or more of the ring resonators.

3. (Original) The tunable laser as claimed in claim 1, wherein the low reflection film of the laser diode chip is abutted against the LD-side waveguide to be optically coupled.

4. (Original) The tunable laser as claimed in claim 1, wherein the low reflection film of the laser diode chip is optically coupled to the LD-side waveguide through an optical device.

5. (Previously Presented) The tunable laser as claimed in claim 4, wherein the optical device comprises a lens.

6. (Canceled)

7. (Previously Presented) The tunable laser as claimed in claim 1, wherein the optical coupling devices comprise directional couplers.

8.-9. (Canceled)

10. (Previously Presented) The tunable laser as claimed in claim 1, further comprising a wavelength detecting device for detecting a resonance wavelength of the multiple ring resonator.

11. (Previously Presented) The tunable laser as claimed in claim 10, wherein the wavelength detecting device lets through or shields light of only a specific range of wavelengths to detect the wavelength.

12. (Original) The tunable laser as claimed in claim 10, comprising a control device for feedback-controlling resonance of the multiple ring resonator based on resonance wavelength information detected by the wavelength detecting device.

13. (Original) The tunable laser as claimed in claim 1, wherein a stray light suppressing part for suppressing influence of a stray light that is emitted from an end face extended from one end of the LD-side waveguide or an end face extended from one end of the reflection-side waveguide is provided.

14. (Original) The tunable laser as claimed in claim 1, wherein a filter for letting through light of only a specific range of wavelengths is inserted at least to one place selected from the LD-side waveguide between the multiple ring resonator and the laser diode chip, the reflection-side waveguide between the multiple ring resonator and the high reflection film, and between the ring resonators.

15. (Original) The tunable laser as claimed in claim 1, wherein a light-receiving element is provided to an end face that is extended from one end of the LD-side waveguide or an end face that is extended from one end of the reflection-side waveguide.

16. (Previously Presented) The tunable laser as claimed in claim 1, wherein the laser diode chip is mounted on the board by a passive alignment technique which thereby renders alignment of the optical axis unnecessary.

17. (Previously Presented) The tunable laser as claimed in claim 15, wherein the light-receiving element is mounted on the board by a passive alignment technique which thereby renders alignment of the optical axis unnecessary.

18. (Previously Presented) The tunable laser as claimed in claim 1, wherein the reflection film comprises one of a dielectric multilayer film and a metal film.

19. (Previously Presented) The tunable laser as claimed in claim 1, wherein the reflection film reflects laser light without tuning regardless of said changed resonance wavelength of said multiple ring resonator.

20.-21. (Canceled)

22. (Previously Presented) The tunable laser as claimed in claim 14, wherein a feedback control is executed such that the resonance wavelength becomes constant.

23.-24. (Canceled)

25. (Previously Presented) The tunable laser as claimed in claim 1, wherein a wavelength of said reflection peak can be shifted over entire regions of the C-band and L-band (1.53 micron – 1.625 micron).

26. (Canceled)

27. (Currently Amended) ~~The tunable laser as claimed in claim 26.~~

A tunable laser, comprising:

a multiple ring resonator in which a plurality of ring resonators, which are constituted with ring-type waveguides having optical path lengths different from each other, are coupled through an optical-coupling device;

an LD-side waveguide having a first end connected to one of the plurality of ring resonators through an optical-coupling device;

a reflection-side waveguide having a first end connected to other one of the plurality of ring resonators through an optical-coupling device;

a single board on which the ring resonator, the LD-side waveguide and the reflection-side waveguide are formed;

a reflection film provided to a second end of the reflection-side waveguide, wherein said reflection film comprises a high-reflection film capable of reflecting laser light without regard to a wavelength of a transmission peak of said laser light;

a laser diode chip having a low reflection film formed on one of two opposing emission end faces, which is optically coupled to the LD-side waveguide through the low reflection film; and

a tuning device for changing a resonance wavelength of only the multiple ring resonator, wherein the tuning device changes refractive indexes of the ring-type waveguides of the ring resonators for changing the resonance wavelength,

wherein the tuning device changes the resonance wavelength of the ring-type waveguides only by temperature-adjusting a refractive index of each of the ring-type waveguides, and

wherein the refractive indexes of each of the ring-type waveguides are temperature-adjusted independently of each other.

28. (Currently Amended) ~~The tunable laser as claimed in claim 8.~~

A tunable laser, comprising:

a multiple ring resonator in which a plurality of ring resonators, which are constituted with ring-type waveguides having optical path lengths different from each other, are coupled through an optical-coupling device;

an LD-side waveguide having a first end connected to one of the plurality of ring resonators through an optical-coupling device;

a reflection-side waveguide having a first end connected to other one of the plurality of ring resonators through an optical-coupling device;

a single board on which the ring resonator, the LD-side waveguide and the reflection-side waveguide are formed;

a reflection film provided to a second end of the reflection-side waveguide, wherein said reflection film comprises a high-reflection film capable of reflecting laser light without regard to a wavelength of a transmission peak of said laser light;

a laser diode chip having a low reflection film formed on one of two opposing emission end faces, which is optically coupled to the LD-side waveguide through the low reflection film; and

a tuning device for changing a resonance wavelength of only the multiple ring resonator, wherein the tuning device changes refractive indexes of the ring-type waveguides of the ring resonators for changing the resonance wavelength,

wherein, in the plurality of ring resonators, diameters of the ring waveguides are set so that intervals of reflection peaks appearing periodically become different, and there generates a resonance at a meeting point of the reflection peaks.